

Swift Observations of GRB 100814A

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1 Introduction

BAT triggered on GRB 100814A at 03:50:11.3 UT (Trigger 431605) (Beardmore, *et al.*, *GCN Circ.* 11087). This was a 1.024 sec rate-trigger on a intermediate length burst with $T_{90} = 174.72$ sec. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 87.4$ sec, and UVOT began settled exposures at $T + 126$ sec. Our best position is the UVOT location $RA(J2000) = 22.47338deg$ (01h29m53.61s), $Dec(J2000) = -17.99545deg$ ($-17d59'43.6''$) with an error of 0.6 arcsec (90% confidence, including boresight uncertainties).

2 BAT Observation and Analysis

Using the data set from $T - 239$ to $T + 963$ sec, further analysis of BAT GRB 100814A has been performed by Swift team (Krimm, *et al.*, *GCN Circ.* 11094). The BAT ground-calculated position is $RA(J2000) = 22.479deg$ (01h29m55.0s), $Dec(J2000) = -17.990deg$ ($-17d59'25.7''$) ± 1.0 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 90%

The masked-weighted light curves (Fig.1) shows 3 FRED-like spikes starting around $T - 4$, $T + 60$ and $T + 140$ seconds. These spikes peak around $T + 5$ sec, $T + 70$ sec and $T + 145$ sec. The flux returns to background at about $T + 235$ sec. $T_{90}(15 - 350keV)$ is 174.5 ± 9.4 (estimated error including systematics).

The time-averaged spectrum from $T - 3$ to $T + 235$ s is best fitted by a simple power law model. This fit gives a photon index of 1.47 ± 0.04 , ($\chi^2 = 32.91$ for 57 d.o.f.). For this model the total fluence in the 15 – 150 keV band is $(9.0 \pm 0.2) \times 10^{-6} ergs/cm^2$ and the 1-sec peak flux measured from $T - 0.06$ s in the 15 – 150 keV band is $2.5 \pm 0.2 ph/cm^2/sec$. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

The refined XRT position of GRB 100814A, obtained by 5.03 ksec in Photon Counting mode) is $RA(J2000) = 22.47308deg$ (01h29m53.54s), $Dec(J2000) = -17.99503 deg$ ($-17d59'42.1''$) ± 1.5 arcsec (90% confidence, including boresight uncertainties). This position is within 6 arcsec of the initial XRT position, and 1.5 arcsec from the optical afterglow candidate, reported by Beardmore *et al.*, *GCN Circ.* 11087.

The X-ray light curve (Fig.2) initially rises by a factor of 2 in count rate, reaching a broad peak at approximately $T + 160$ sec after the trigger, on top of which are superimposed three small flares at $T + 146$, 176 and 220 sec, respectively. At $T + 295$ sec the light curve falls with a steep decay of $\alpha=5.7$ (+0.4, -0.3), then breaks to a shallow decay at $T+517$ s, after which it decays with an index of 0.51 ± 0.1 .

The initial peak of the X-ray lightcurve and the following phases can be modeled with an absorbed power-law with spectral indices of 0.66 ± 0.02 and 0.95 ± 0.03 , respectively. The intrinsic NH column density is $1.6 \times 10^{21} cm^{-2}$. The average observed (unabsorbed) flux over 0.3 – 10 keV for this spectrum (spanning a time of 93-145233 seconds after the trigger) is 3.83×10^{-11} (4.17×10^{-11}) $ergs/cm^2/sec$.

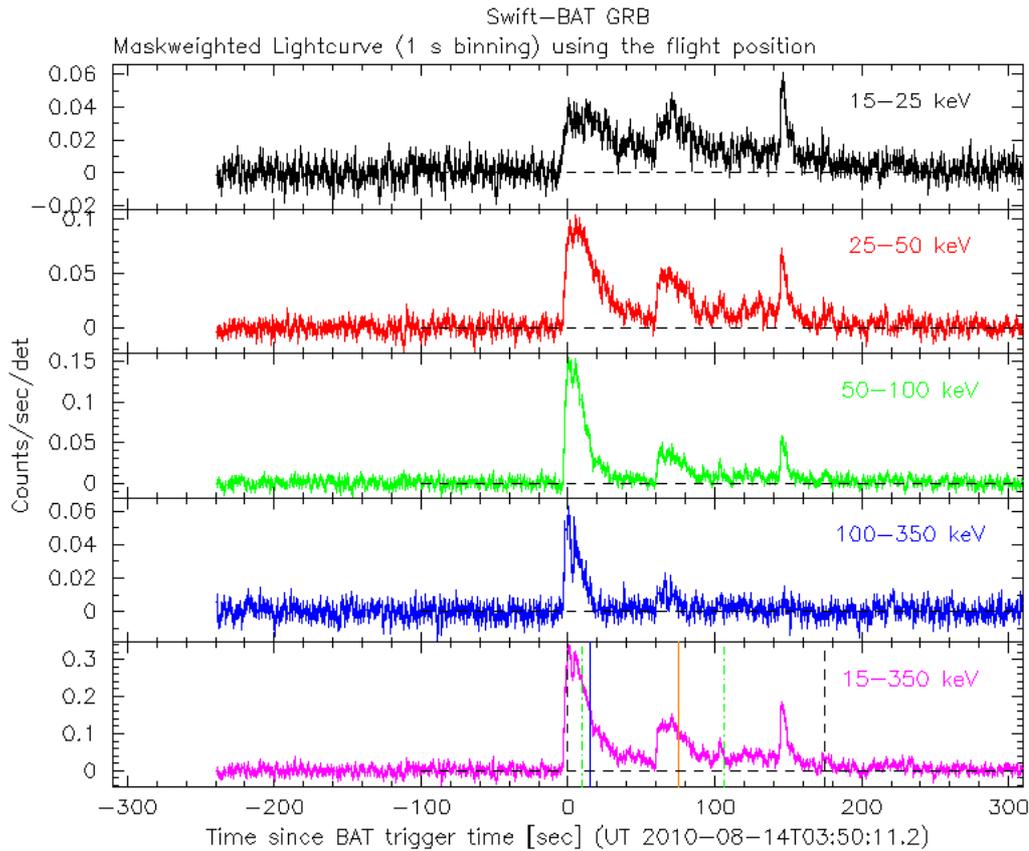


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 03:50:11.1 UT.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 100814A at 03:51:32 UT, 81 sec after the initial BAT trigger (Beardmore *et al.*, *GCN Circ.* 11087). Settled exposures began 153s after the trigger. A new source was detected within the XRT error circle in the u (250 s) finding chart (fc) exposure and in other filter exposures but uvw2. Epochs, exposures and magnitudes are summarized in Table 1. Magnitudes and 3σ upper limits are not corrected for Galactic extinction $E(B-V) = 0.02$.

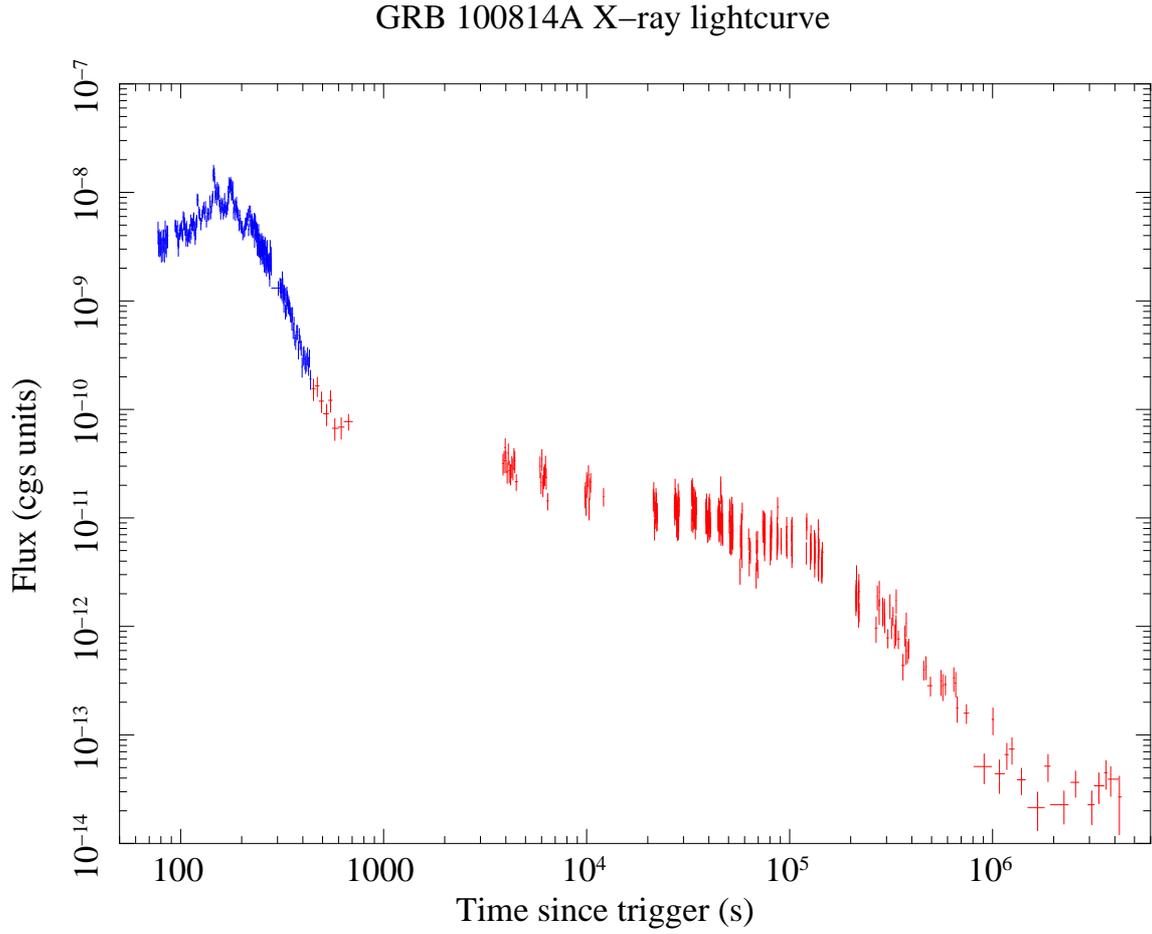


Figure 2: XRT Lightcurve. Flux is in the 0.3-10 keV band: Window Timing mode (black), Photon Counting mode (red). The approximate conversion (unabsorbed) is 1 count/sec = $\sim 4.3 \times 10^{-11}$ *ergs/cm²/sec*.

Filter	Start	Stop	Exposure	Magnitudes and 3σ UL
WHITE	3858	4211	344	18.63 ± 0.07
V	458	627	39	17.91 ± 0.32
B	408	721	53	18.51 ± 0.28
U (fc)	153	403	246	16.84 ± 0.06
U	536	556	19	17.10 ± 0.19
UVW1	507	676	39	17.33 ± 0.20
UVM2	483	651	39	17.80 ± 0.43
UVW2	434	602	39	> 18.40

Table 1: Magnitudes and 3σ upper limits from UVOT observations.